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THE ENTOCYTHERID OSTRACOD FAUNA OF NORTHERN GEORGIA

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Abstract.—The entocytherid ostracod fauna of the Tennessee and Coosa river basins (exclusive of the Tallapoosa sub-basin of the latter) in Georgia consists of 13 species that infest one or more of 26 of the 27 epigean crayfishes frequenting these watersheds. None of the ostracods is restricted to the area, and there is no evidence that any of them require a specific host. Spot maps depicting the locality records for each ostracod, summaries of their ranges, and their associations with the crayfish hosts and other entocytherids occurring in the area are tabulated. A key for recognizing the ostracods is also included.

Introduction

During a survey of the crayfish fauna of Georgia (Hobbs 1981), many of the entocytherid ostracods infesting these decapods were preserved for future study. Those available from the Coosa (exclusive of the Tallapoosa) and Tennessee river basins, an area herein designated as "northern Georgia," constitute the material on which this is based.

The entocytherid ostracods are obligate symbionts of aquatic amphipods, isopods, crayfishes, and crabs. Only members of the nominate subfamily occur in Georgia, and all are associated with crayfishes. The entocytherid fauna of the area treated here consists of 13 species that infest one or more of 26 of the 27 epigean species of cambarine crayfishes frequenting the Coosa and Tennessee watersheds.

Not one of the 13 entocytherids is restricted to northern Georgia, but we anticipate that the southeastern limits of the range of at least two of them (*Ascetocythere bouchardi* and *Dactylocythere prominula*) will prove to lie within the area. Few of the members of the genus *Dactylocythere* are expected to be found to the south except in the headwaters of the Chattahoochee and Savannah rivers.

The area under consideration.—The Coosa and Tennessee rivers (Fig. 1) drain some 12,000 and 7250 square kilometers, respectively, of the northern part of Georgia. Within this area, there are segments of four of the five physiographic regions represented in the state (Fig. 2). Furthermore, elevations range from approximately 152 to 1450 meters.

The headwater streams and most of the creeks and rivers outside of the Ridge and Valley Province flow, for the most part, over granitic or sandstone beds and thus have low mineral content. Those coursing at lower elevations of the Ridge and Valley Province flow over eroded beds of Paleozoic limestone, dolomite, and shale and are enriched by calcium and magnesium salts.

A broad array of habitats ranging from seepage areas and mountain rills to rather large, sluggish streams and crayfish burrows is available to the entocytherids in this section of the state, and whereas all appear to have been exploited by the ostracods, we have been able to recognize few correlations of their

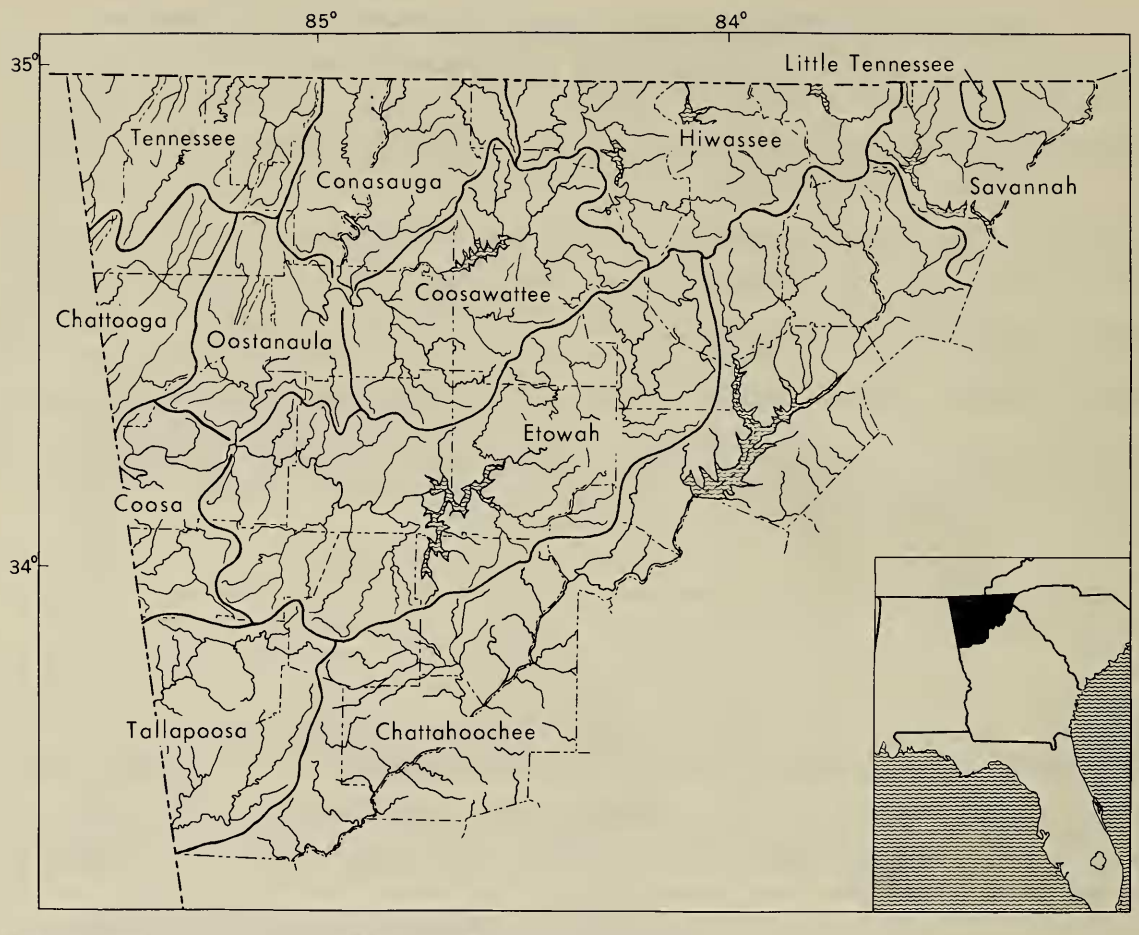

Fig. 1. River basins in northern Georgia.

distribution with ecological conditions. Unlike entocytherid faunas in other areas in which unique species are symbionts of those crayfishes largely restricted to burrows, the ostracods infesting the burrowing crayfishes in northern Georgia are members of some of the same species that are found on the stream-dwelling crayfishes frequenting nearby epigean habitats. The ostracods occurring in the physiographic provinces and drainage basins are summarized in Table 1.

Entocytherid associates and infestations.—As we stated in our summary of the entocytherids of North Carolina (Hobbs and Peters 1977:4), "In . . . [northern Georgia], as elsewhere, frequently more than one entocytherid infests the same crayfish, and in this study the ostracods were, for the most part, obtained from collections of crayfishes in which all of the specimens collected in one locality were preserved in the same container. Thus, if two or three species of crayfishes were obtained at one station, we were unable to determine which of the ostracods retrieved from the container infested which host species. The only instances in which we can be certain that an entocytherid was associated with a particular host species are those in which collections contain only one species of crayfish. In Table 2, the associations indicated are based in part upon records of ostracods occurring in the same locality, perhaps infesting more than one species of crayfish (open circles) rather than occurring on the same host species (solid circles)." Our collections were obtained from 154 localities (Fig. 3).

Whereas an obligate association with one or more crayfishes exists for all of the entocytherids of the area, evidence exists that none requires a specific host.

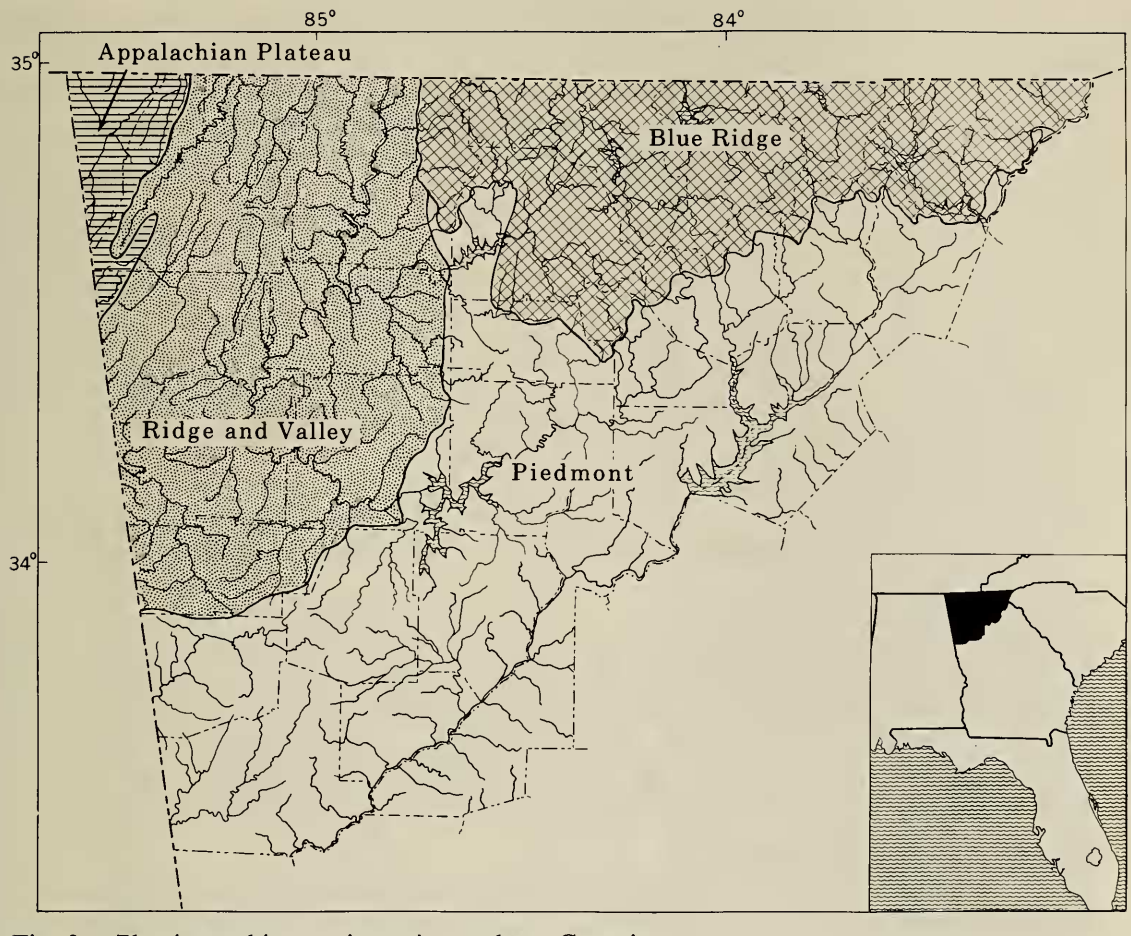

Fig. 2. Physiographic provinces in northern Georgia.

The only ostracod known to be associated with a single host species in the region is *Dactylocythere prominula* which was found in a single locality on a small mountain stream in which only one crayfish, *Cambarus* (*C.*) *bartonii,* was collected. In several localities in Tennessee, however, it has been found on other crayfishes (Hobbs and Walton 1977:609), and we believe it highly likely that it will be found on species other than *C.* (*C.*) *bartonii* in northern Georgia.

Entocytherid distribution in northern Georgia.—The numbers of entocytherids (Table 1) and crayfishes (Hobbs 1981:table 2) occurring in the four provinces in northern Georgia are as follows:

Provinces	Entocytherids	Crayfishes
Appalachian Plateau	6	8
Ridge and Valley	10	19
Blue Ridge	7	13
Piedmont	7	8

Obviously the Ridge and Valley Province supports the largest number of both entocytherids and crayfishes: 10 of the 13 known ostracods and 20 of the 27 crayfishes. Despite the relatively small area of northern Georgia encompassed by the Appalachian Plateau, almost half of the species comprising the entocytherid fauna have been found within it.

Entocythere elliptica and *Uncinocythere simondsi* are the most widespread entocytherids in northern Georgia, both occurring in all of the physiographic

Table 1.—Distribution of entocytherids in the physiographic provinces and drainage basins of northern Georgia.

	ENTOCYTHERIDS												
	An. telmoecea	*As. bouchardi*	*C. cyma*	*Dt. brachystrix*	*Dt. falcata*	*Dt. leptophylax*	*Dt. mecoscapha*	*Dt. prominula*	*Dt. suteri*	*Dn. donnaldsonensis*	*E. elliptica*	*E. illinoisensis*	*U. simondsi*
PROVINCES													
Appalachian Plateau		●		●			●			●	●		●
Ridge and Valley	●		●	●	●	●	●		●		●	●	●
Blue Ridge			●		●	●		●		●	●		●
Piedmont	●		●		●	●				●	●		●
DRAINAGE BASINS													
Tennessee	●	●		●	●		●			●	●	●	●
Hiwassee					●	●	●			●	●		●
Little Tennessee					●	●				●			
Coosa			●		●						●		●
Conasauga			●		●	●		●	●		●		●
Coosawattee			●		●	●					●		●
Etowah	●				●	●				●	●		●
Chattooga			●		●						●		●

provinces and in all major drainage basins except the Little Tennessee. Only slightly less broadly distributed is *Dactylocythere falcata,* which has not been found on the Appalachian Plateau. In contrast, *Ascetocythere bouchardi, Dactylocythere brachystrix, Dt. prominula, Dt. suteri,* and *Entocythere illinoisensis* have the most restricted ranges. The first of these has been found in four localities in the Tennessee Basin lying on the Appalachian Plateau. *Dactylocythere brachystrix* is a little more widespread, for while known only from the Tennessee Basin, it occurs in streams of both the Appalachian Plateau and Ridge and Valley provinces. *Dactylocythere prominula* was discovered in only a single locality, that lying in the Conasauga Basin of the Blue Ridge Province. *Dactylocythere suteri* was obtained in several localities in the same river basin, but in the Ridge and Valley instead of the Blue Ridge Province. Like *Dt. prominula, E. illinoisensis* was found in a single locality in the area, but one lying in the Tennessee watershed of the Ridge and Valley Province.

Table 2.—The entocytherids and their crayfish hosts in northern Georgia (solid circles = known host-commensal relationships; open circles = occurrence in same locality; see "Entocytherid associates and infestations" for more detailed explanation).

HOSTS	ENTOCYTHERIDS												
	An. telmoecea	*As. bouchardi*	*C. cyma*	*Dt. brachystrix*	*Dt. falcata*	*Dt. leptophylax*	*Dt. mecoscapha*	*Dt. prominula*	*Dt. suteri*	*Dn. donnaldsonensis*	*E. elliptica*	*E. illinoisensis*	*U. simondsi*
C. (C.) bartonii					○	●	●	●		●	●		●
C. (D.) cymatilis					○						○		○
C. (D.) latimanus	○		○		●	●	○				●		●
C. (D.) striatus	○		●		●		○		●	○	●	○	●
C. (H.) coosawattae					○	○					○		○
C. (H.) fasciatus	○		○		○	○				○	●		○
C. (H.) girardianus					○		●			●	○	○	●
C. (H.) longirostris	○				●		○				●		○
C. (H.) manningi					●						○		○
C. (H.) speciosus					●	○					●		●
C. (J.) conasaugaensis			○		○	●				○	○		●
C. (J.) distans										●			
C. (J.) nodosus										○	○		
C. (J.) parvoculus		●		○						○			○
C. (J.) unestami		●		●			○			●	●		○
C. (L.) acanthura			○		○				○		○		○
C. (P.) coosae			○		●	●			●		●		●
C. (P.) extraneus	○				○		○				○	○	○
C. (P.) georgiae					●					●			
C. (P.) hiwasseensis					●	○	○			○	●		○
C. (P.) parrishi					●	●				●	●		
C. (P.) scotti			○		●						●		○
O. erichsonianus	○		○		●		○			○	●	○	●
O. forceps													
O. spinosus			○		●		○		○		○		○
P. (O.) lophotus					○		○				○	○	○
P. (Pe.) spiculifer	○		○		○	●					●		○

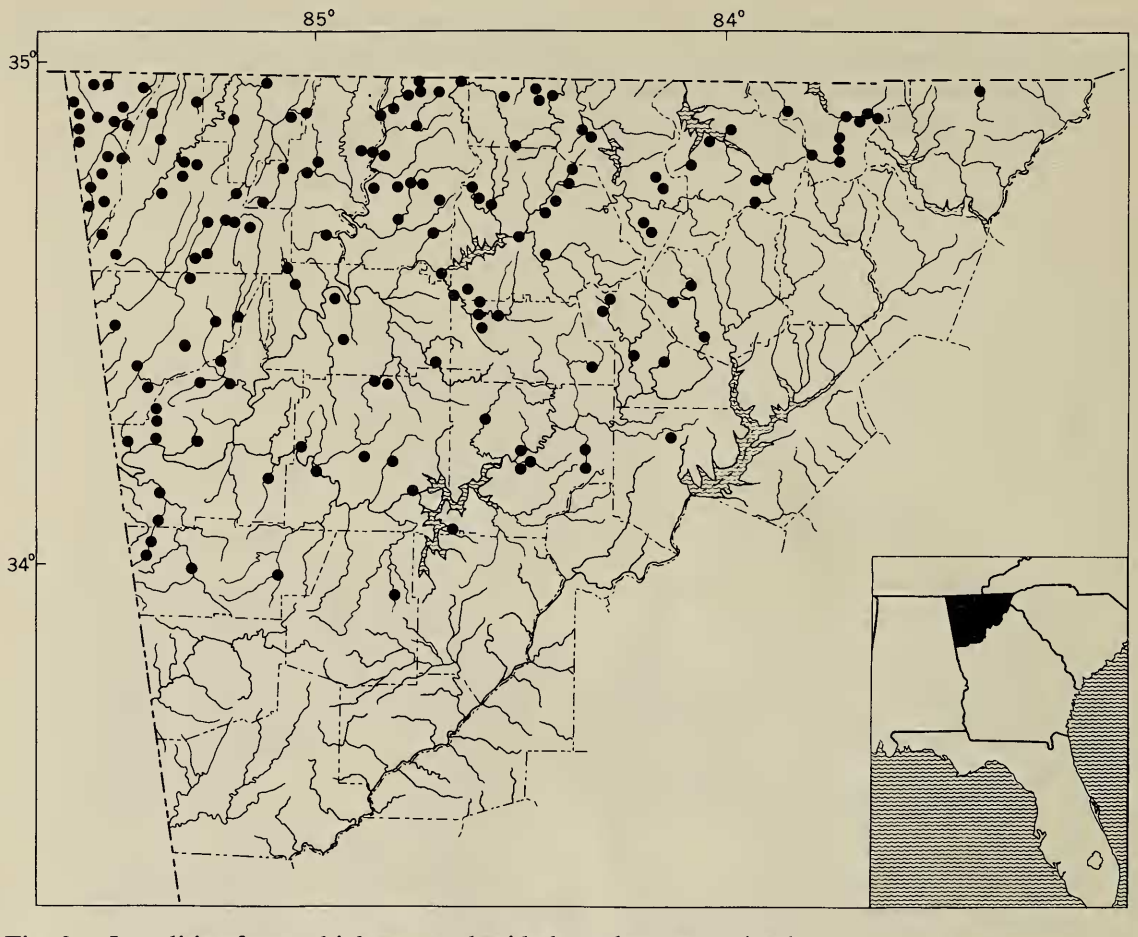

Fig. 3. Localities from which entocytherids have been examined.

Finding *Ankylocythere telmocea* in the Tennessee Basin, and especially in the Ridge and Valley Province, came as a real surprise to us for elsewhere in its range it has been reported only from the Piedmont and Coastal Plain provinces (see Hart and Hart 1974:32–33). This isolated locality, and perhaps others in the province, should be investigated further to assure the validity of the occurrence of the species in the Tennessee River basin.

In respect to their hosts, *Entocythere elliptica* is apparently the least selective of the entocytherids occurring in northern Georgia, having been definitely associated with 13, and possibly occurring on as many as 23, of the 27 crayfishes inhabiting the area. Only slightly less selective are *Dactylocythere falcata* and *Uncinocythere simondsi*. The former has been found on 12 species of crayfishes frequenting the area, and the possibility exists that 10 additional host species are also infested by *Dt. falcata*. *Uncinocythere simondsi* has found the exoskeleton of all of the crayfishes acceptable for colonization except perhaps those of *Cambarus* (*J.*) *nodosus*, *C.* (*J.*) *distans*, *C.* (*P.*) *georgiae*, *C.* (*P.*) *parrishi*, and *O. forceps*.

Although most studies have indicated that crayfishes of the genus *Orconectes*, in general, support smaller numbers of ostracods than do most members of other cambarine genera, we are not confident that *Orconectes forceps* lacks entocytherid infestations. The few collections of this crayfish from Georgia streams that are available to us were not maintained in the original containers in which they were collected, and the fluid in which they were killed had been discarded.

Table 3.—Associations of entocytherids in northern Georgia (solid circles = known utilization of same host species in at least one locality; open circles = occurrence in same locality; see "Entocytherid associates and infestations" for more detailed explanation).

ENTOCYTHERIDS	ENTOCYTHERID ASSOCIATES												
	An. telmoecea	*As. bouchardi*	*C. cyma*	*Dt. brachystrix*	*Dt. falcata*	*Dt. leptophylax*	*Dt. mecoscapha*	*Dt. prominula*	*Dt. suteri*	*Dn. donnaldsonensis*	*E. elliptica*	*E. illinoisensis*	*U. simondsi*
An. telmoecea	■				○	○	○				○		○
As. bouchardi		■		○						○			○
C. cyma			■		○	○			○		○		○
Dt. brachystrix		○		■						○	●		
Dt. falcata	○		○		■	●	○		●		●		●
Dt. leptophylax	○		○		●	■	○	●		●	●		●
Dt. mecoscapha	○				○	○	■			●	○	○	●
Dt. prominula						●		■			●		
Dt. suteri			○		●				■		○		●
Dn. donnaldsonensis		○		○		●	●			■	●		●
E. elliptica	○		○	●	●	●	○	●	○	●	■	○	●
E. illinoisensis							○				○	■	○
U. simondsi	○	○	○		●	●	●		●	●	●	○	■

Cambarus (*J.*) *distans* has been found in only two localities, both on an intermittent stream in the northern part of Dade County, and in one of them it is infested with *Donnaldsoncythere donnaldsonensis,* one of the most widely ranging entocytherids in the eastern half of the United States. *Cambarus* (*P.*) *georgiae,* known from a single locality in the Georgia segment of the Little Tennessee River, harbors two of the three ostracods known to occur in the headwaters of that stream.

The burrowing *Cambarus* (*D.*) *cymatilis* and *C.* (*J.*) *nodosus* and the riffle-inhabiting *C.* (*H.*) *manningi* are infested by three, two, and three entocytherid species, respectively, but the ostracods on them are among the commonest in the area, infesting a comparatively large variety of crayfish hosts (Table 1).

In contrast, the least ecologically restricted crayfish in the area, *Cambarus* (*D.*) *striatus,* has been found to host five and possibly nine entocytherids. *Cambarus* (*C.*) *bartonii* and *C.* (*P.*) *coosae* harbor six and five species of entocytherids, respectively, and possibly an additional one occurs on each.

The host species in the area have been treated by Hobbs (1981), and synonymies, ranges, and notes on their biology are recorded therein. The epigean crayfish fauna of northern Georgia, as delimited here, consists of the following species: *Cambarus* (*Cambarus*) *bartonii* (Fabricius, 1798); *C.* (*Depressicambarus*) *cymatilis* Hobbs, 1970; *C.* (*D.*) *latimanus* (LeConte, 1856); *C.* (*D.*) *striatus* Hay, 1902; *C.* (*Hiaticambarus*) *coosawattae* Hobbs, 1981; *C.* (*H.*) *fasciatus* Hobbs, 1981; *C.* (*H.*) *girardianus* Faxon, 1884; *C.* (*H.*) *longirostris* Faxon, 1885; *C.* (*H.*) *manningi* Hobbs, 1981; *C.* (*H.*) *speciosus* Hobbs, 1981; *C.* (*Jugicambarus*) *conasaugaensis* Hobbs and Hobbs, 1962; *C.* (*J.*) *distans* Rhoades, 1944; *C.* (*J.*) *nodosus* Bouchard and Hobbs, 1976; *C.* (*J.*) *parvoculus* Hobbs and Shoup, 1947; *C.* (*J.*) *unestami* Hobbs and Hall, 1969; *C.* (*Lacunicambarus*) *acanthura* Hobbs, 1981; *C.* (*Puncticambarus*) *coosae* Hobbs, 1981; *C.* (*P.*) *extraneus* Hagen, 1870; *C.* (*P.*) *georgiae* Hobbs, 1981; *C.* (*P.*) *hiwasseensis* Hobbs, 1981; *C.* (*P.*) *parrishi* Hobbs, 1981; *C.* (*P.*) *scotti* Hobbs, 1981; *Orconectes erichsonianus* (Faxon, 1898); *O. forceps* (Faxon, 1884); *Orconectes spinosus* (Bundy, 1877); *Procambarus* (*Ortmannicus*) *lophotus* Hobbs and Walton, 1960; *P.* (*Pennides*) *spiculifer* (LeConte, 1856).

Key to Entocytherid Fauna of Northern Georgia
(Based on male copulatory complex)

1. External border of horizontal ramus of clasping apparatus with simple excrescence ..... *Ankylocythere telmoecea*
1′. External border of horizontal ramus of clasping apparatus entire .. 2
2(1′). Penis with prostatic and spermatic elements distinctly diverging along part of their length; ventral part of peniferum deeply cleft posteriorly ..... *Ascetocythere bouchardi*
2′. Penis with prostatic and spermatic elements contiguous throughout their lengths; ventral part of peniferum never deeply cleft posteriorly 3
3(2′). Ventral part of peniferum bulbous ..... *Cymocythere cyma*
3′. Ventral part of peniferum never bulbous 4
4(3′). Finger guard absent 5
4′. Finger guard present ..... *Dactylocythere* 8
5(4′). Rami of clasping apparatus disposed at angle of no more than 70 degrees ..... *Donnaldsoncythere donnaldsonensis*
5′. Rami of clasping apparatus disposed at angle of at least 90 degrees 6
6(5′). Clasping apparatus with internal border of horizontal ramus not serrate, bearing maximum of 3 teeth ..... *Uncinocythere simondsi*
6′. Clasping apparatus with internal border of horizontal ramus serrate, bearing 5 teeth ..... *Entocythere* 7
7(6′). Clasping apparatus with external border of junction of horizontal and vertical rami produced in angle ..... *Entocythere illinoisensis*
7.′ Clasping apparatus with external border of junction of horizontal and vertical rami broadly rounded ..... *Entocythere elliptica*
8(4′). Clasping apparatus "U" or "C" shaped, distal part expanded ..... *Dactylocythere leptophylax*

8′. Clasping apparatus "L" shaped, distal part tapering 9

9(8′). Accessory groove short, never reaching above dorsal margin of spermatic loop 10

9′. Accessory groove long, reaching distinctly dorsal to spermatic loop 11

10(9). Accessory groove never reaching dorsal margin of spermatic loop; vertical ramus of clasping apparatus bowed ..... *Dactylocythere brachystrix*

10′. Accessory groove reaching dorsal margin of spermatic loop; vertical ramus sometimes with shoulder but never distinctly bowed ..... *Dactylocythere suteri*

11(9′). Finger guard jutting anteroventrally ..... *Dactylocythere prominula*

11′. Finger guard directed ventrally 12

12(11′). External border of junction of horizontal and vertical rami of clasping apparatus angular; more than one tooth on internal border of horizontal ramus ..... *Dactylocythere mecoscapha*

12′. External border of junction of horizontal and vertical rami of clasping apparatus rounded; never more than one tooth on internal border of horizontal ramus ..... *Dactylocythere falcata*

Annotated List of Species

In the following annotated list of ostracods, complete synonymies are furnished for only those species (*Ascetocythere bouchardi* and *Dactylocythere prominula*) that have been described since the publication of a monograph of the family (Hart and Hart 1974) in which the remaining species are fully treated. Locality records are included only for those species that are known from as few as 10 localities. For information concerning the crayfish hosts, Hobbs (1981) should be consulted.

Ankylocythere telmoecea (Crawford)
Fig. 4

Entocythere telmoecea Crawford, 1959:167–173, figs. 24–30.

Ankylocythere telmoecea.—Hart, 1962:128.—Hart and Hart, 1974:32–33, pl. 4, figs. 1–5; pl. 46.—Hobbs, 1981:498–501.

Uncinocythere lucifuga.—Hart and Hart, 1974:131 [in part; not *Entocythere lucifuga* Walton and Hobbs, 1959].

Range.—"From the Flint River drainage in Georgia to the York Basin in Virginia" (Hobbs and Peters 1977:18).

Previous records in northern Georgia.—Hart and Hart (1974) reported the occurrence of *Uncinocythere lucifuga* in northern Georgia (see locality 4 below). We have examined the specimen on which this record was based and it appears to us to be a member of *A. telmoecea*.

Distribution in northern Georgia.—Except for a single locality in the Chickamauga Creek watershed (Tennessee Basin), all of them are situated in the Etowah drainage system. Our seven locality records are as follows: CHEROKEE COUNTY: (1) stream 2 mi W of Free Home on St Rte 20 (hosts: *C.* (*D.*) *latimanus*, *P.* (*Pe.*)

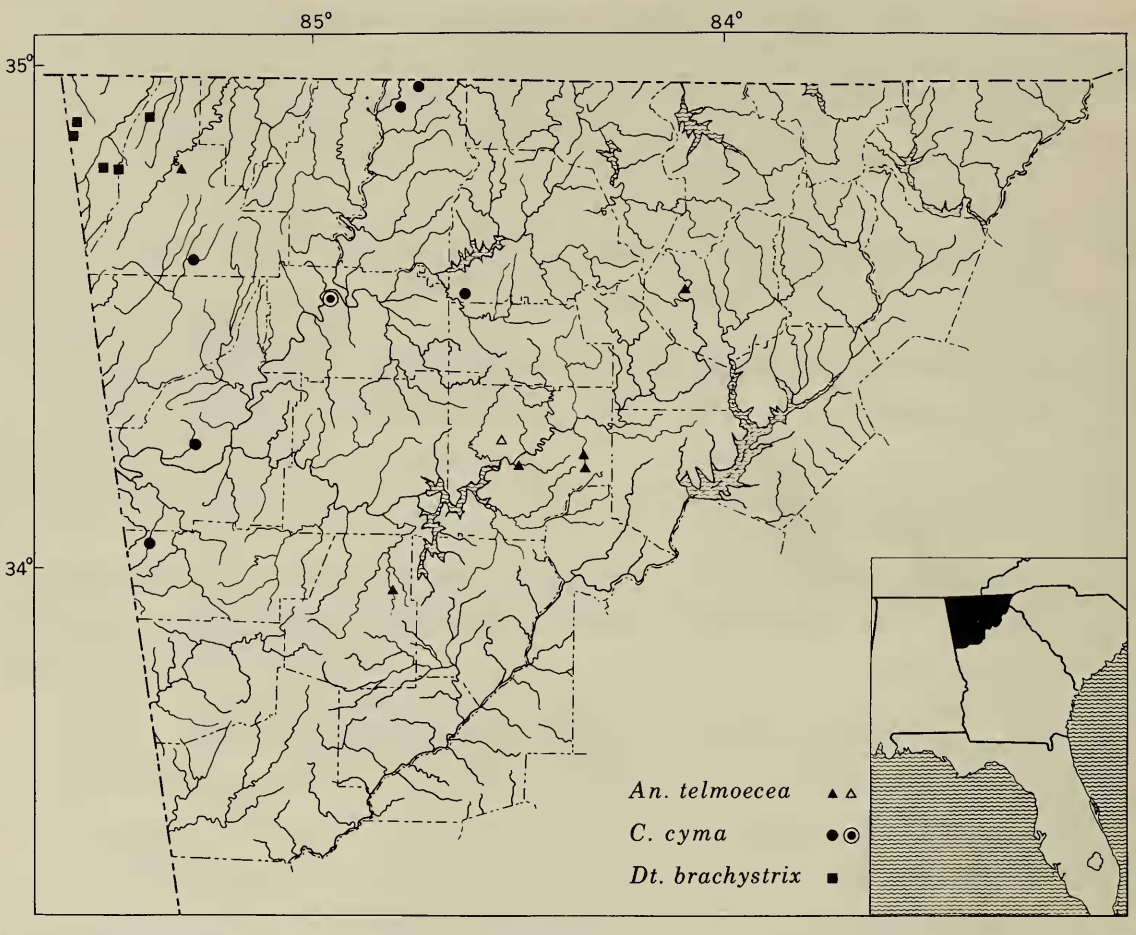

Fig. 4. Distribution of *Ankylocythere telmoecea, Cymocythere cyma,* and *Dactylocythere brachystrix* in northern Georgia (encircled spot and open triangle denote previously reported localities).

spiculifer; associates: *Dt. leptophylax, U. simondsi*); (2) stream 1 mi W of Free Home and 1.5 mi S of Rte 20 (hosts: *C.(D.) latimanus, C. (D.) striatus, P. (Pe.) spiculifer*; associate: *E. elliptica*); (3) Scott Mill Creek at St Rte 140, 2 mi SE of Canton (hosts: *C. (D.) latimanus, P. (Pe.) spiculifer*; associates: *Dt. falcata, Dt. leptophylax, E. elliptica, U. simondsi*); (4) stream 3.0 mi N of Canton (Hart and Hart 1974:131) (hosts: *C. (D.) latimanus, P. (Pe.) spiculifer*; no associate cited). LUMPKIN COUNTY: (5) Etowah River at St Rte 52 (hosts: *C. (D.) latimanus, C. (H.) fasciatus, P. (Pe.) spiculifer*; associate: *U. simondsi*). PAULDING COUNTY: (6) Possum Creek 1.3 mi NE of U.S. Hwy 278 on St Rte 92 (hosts: *C. (D. latimanus, P. (Pe.) spiculifer*; no associates). WALKER COUNTY: (7) trib to Chickamauga Creek 0.5 mi N of St Rte 143 on Rte 341 (hosts: *C. (H.) longirostris, C. (P.) extraneus, O. erichsonianus*; associate: *Dt. mecoscapha*).

Ascetocythere bouchardi Hobbs and Walton
Fig. 5

Ascetocythere bouchardi Hobbs and Walton, 1975:7–10, fig. 1a–d.

Range.—This ostracod ranges in the Tennessee River basin, on the Cumberland Plateau, from Cumberland County, Tennessee southward to Dade County, Georgia.

Previous records in northern Georgia.—None.

Distribution in northern Georgia.—In Georgia, *Ascetocythere bouchardi* has been found in only four localities, all situated on Sand Mountain, Dade County, in tributaries of the Tennessee River: (1) trib to Warren Creek on unnumbered road 0.3 mi E of Alabama line and 1.0 mi N of St Rte 301 (host: *C.* (*J.*) *parvoculus*; no associates); (2) trib to Warren Creek 0.4 mi N of St Rte 301 (hosts: *C.* (*J.*) *parvoculus, C.* (*J.*) *unestami*; associates: *Dt. brachystrix, U. simondsi*); (3) creek at Alabama line about 1.5 mi S of St Rte 301 (hosts: *C.* (*J.*) *parvoculus, C.* (*J.*) *unestami*; associates: *Dt. brachystrix, Dn. donnaldsonensis*); (4) Higdon Creek about 2.0 mi W of Stephensville on St Rte 143 (hosts: *C.* (*J.*) *parvoculus, C.* (*J.*) *unestami*; associate: *Dn. donnaldsonensis*).

Cymocythere cyma (Hobbs and Walton)
Fig. 4

Entocythere cyma Hobbs and Walton, 1960:18–19, figs. 11–16.
Cymocythere cyma.—Hart, 1962:129.—Hart and Hart, 1974:44, pl. 9, figs. 7–11; pl. 47.—Hobbs, 1981:215, 499, 500.

Range.—From Anderson County, Tennessee, to Jefferson County, Alabama, and from Murray County, Georgia, to Hardin County, Tennessee. Encompassing the Altamaha, Coosa-Alabama, and Tennessee river basins.

Previous records in northern Georgia.—Only one locality has been cited for this species in the northern part of the state, this in a small tributary to the Oostanaula River (Hart and Hart 1974; see below).

Distribution in northern Georgia.—*Cymocythere cyma* is widely distributed but uncommon throughout most of the Coosa River basin (including the Chattooga) of Georgia, although it has not been found in the Etowah watershed. The type-locality (Four Mile Creek, 1.8 mi SW of Benton, Polk County, Tennessee) is situated in the Hiwassee drainage system some 20 air miles from the upper reaches of the basin in Georgia, but we have no specimens from segments of the river system in the state. Localities from which our specimens were collected are the following. Floyd County: (1) stream 5.0 mi W of Rome on St Rte 20 (hosts: *C.* (*D.*) *striatus, C.* (*L.*) *acanthura, C.* (*P.*) *coosae, O. spinosus, P.* (*Pe.*) *spiculifer*; associates: *Dt. falcata, U. simondsi*). Gilmer County: (2) Hell's Creek between St Rtes 5 and 156, 2.5 mi NW of Pickens Co line (hosts: *C.* (*D.*) *latimanus, C.* (*H.*) *fasciatus, C.* (*J.*) *conasaugaensis, C.* (*L.*) *acanthura*; associates: *Dt. leptophylax, U. simondsi*). Gordon County: 1.8 mi N of Calhoun on U.S. Hwy 41 (Hart and Hart 1974) (hosts: *C.* (*D.*) *striatus, C.* (*L.*) *acanthura, P.* (*Pe.*) *spiculifer*; no associate cited). Murray County: (4) trib of Conasauga River 0.8 mi N of St Rte 2 on U.S. Hwy 411 (hosts: *C.* (*D.*) *striatus, C.* (*L.*) *acanthura, C.* (*P.*) *coosae*; associates: *Dt. falcata, Dt. suteri, U. simondsi*); (5) drainage ditch 2.1 mi E of Conasauga River on St Rte 2 (hosts: *C.* (*D.*) *striatus, C.* (*L.*) *acanthura*; associates: *Dt. suteri, U. simondsi*). Polk County: (6) Little Cedar Creek on Esom Hill Rd, upstream from Hematite Branch (hosts: *C.* (*D.*) *latimanus, C.* (*D.*) *striatus, C.* (*P.*) *coosae*; associate: *E. elliptica*). Walker County: (7) 6 mi S of Lafayette at jct of U.S. Hwy 27 and St Rte 143 (hosts: *C.* (*D.*) *striatus, C.* (*P.*) *scotti, O. erichsonianus*; associate: *Dt. falcata*).

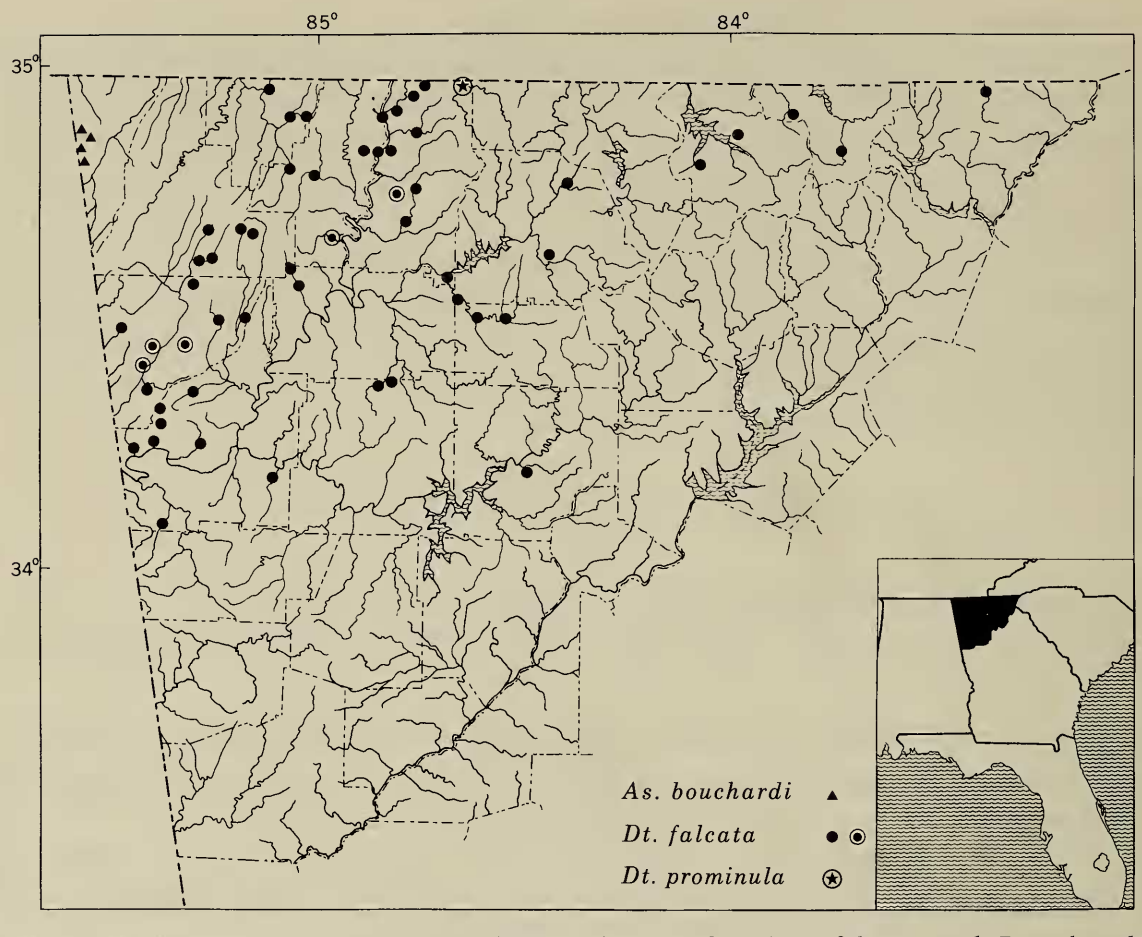

Fig. 5. Distribution of *Ascetocythere bouchardi, Dactylocythere falcata,* and *Dactylocythere prominula* in northern Georgia (encircled spot denotes previously reported locality).

Dactylocythere brachystrix Hobbs and Walton
Fig. 4

Dactylocythere brachystrix Hobbs and Walton, 1966:2–3, fig. 1a–d.—Hart and Hart, 1974:50–51, pl. 11, figs. 7–11; pl. 48.

Range.—This ostracod is known only from the Tennessee River basin, in which it ranges on the Cumberland Plateau and Highland Rim from Cumberland County southwestward to Lawrence County, Tennessee, and on the Plateau and in the Ridge and Valley Province in Dade and Walker counties, Georgia.

Previous records in northern Georgia.—None.

Distribution in northern Georgia.—Dactylocythere brachystrix has been found in five localities in the Tennessee Basin on Sand and Lookout mountains. DADE COUNTY: (1) trib to Warren Creek, 0.4 mi N of St Rte 301 (hosts: *C.* (*J.*) *parvoculus, C.* (*P.*) *unestami*; associates: *As. bouchardi, U. simondsi*). (2) creek at Alabama line about 1.5 mi S of St Rte 301 (hosts: *C.* (*J.*) *parvoculus, C.* (*P.*) *unestami*; associates: *As. bouchardi, Dn. donnaldsonensis*). (3) trib to Lookout Creek on St Rte 143, 2.5 mi W of Walker Co line (host: *C.* (*J.*) *unestami*; no associates); (4) Bear Creek at St Rte 157 (host: *C.* (*J.*) *unestami*; no associates). WALKER COUNTY: (5) Rock Creek at old St Rte 193 on Lookout Mt (host: *C.* (*J.*) *unestami*; associate: *E. elliptica*).

Dactylocythere falcata (Hobbs and Walton)
Fig. 5

Entocythere falcata Hobbs and Walton, 1961:379–381, figs. 2, 3, 7, 8.
Dactylocythere falcata.—Hart, 1962:130.—Hart and Hart, 1974:58–59, pl. 15, figs. 1–5; pl. 49.—Hobbs, 1981:231, 238, 257, 295, 499.

Range.—"From the Coosa River drainage in Georgia and northeastern Alabama to the Tennessee Basin in Virginia, and east of the Appalachian Divide in the upper James and Roanoke drainage systems in Virginia. The records from Missouri and Canada cited by Hart and Hart (1974:48, 49) should be confirmed" (Hobbs and Peters 1977:30).

Previous records in northern Georgia.—Hart and Hart (1974) reported the occurrence of this crayfish in six localities in the Coosa Basin of Georgia: three in Chattooga (the Floyd County record, 23 mi NW of Rome, is actually in Chattooga County), and one each in Murray and Whitfield counties (see open circles in Fig. 5) and an unknown one in Walker County.

Distribution in northern Georgia.—This ostracod, one of the commonest in the area, has been found in 54 localities where it occurs in all of the physiographic provinces except the Appalachian Plateau and in all of the drainage basins. Hosts include all of the crayfishes reported from the area except *C.* (*J.*) *distans*, *C.* (*J.*) *parvoculus*, *C.* (*J.*) *nodosus*, *C.* (*J.*) *unestami*, and *O. forceps*. It has been found in association with the following entocytherids: *C. cyma*, *Dt. leptophylax*, *Dt. mecoscapha*, *Dt. suteri*, *E. elliptica*, and *U. simondsi*.

Dactylocythere leptophylax (Crawford)
Fig. 6

Entocythere leptophylax Crawford, 1961:238–242, figs. 9–14.
Dactylocythere leptophylax.—Hart, 1962:130.—Hart and Hart, 1974:61–62, pl. 16, figs. 1–5; pl. 48.—Hobbs, 1981:70, 257, 450, 598, 500.

Range.—From the Savannah River basin in Oconee County, South Carolina, westward through the upper Chattahoochee, Ocmulgee, and Coosa basins in Georgia, and in the French Broad, Little Tennessee, and Hiwassee drainage systems in Tennessee. A single specimen from the Duck River watershed in Lewis County, Tennessee (Little Swan Creek in Meriweather Lewis Monument Park), suggests the occurrence of an outlying population there.

Previous records in northern Georgia.—The only report of the occurrence of this ostracod in the area is that of Hart and Hart (1974:60) who recorded it from Neel's Gap, Union County, on *Cambarus* (*C.*) *bartonii*.

Distribution in northern Georgia.—*Dactylocythere leptophylax* has been found in 40 localities in the Ridge and Valley, Blue Ridge, and Piedmont provinces of northern Georgia where it occurs in the Conasauga, Coosawattee, Hiwassee, Little Tennessee, and upper Etowah basins. Its hosts in the area are *C.* (*C.*) *bartonii*, *C.* (*D.*) *latimanus*, *C.* (*H.*) *coosawattae*, *C.* (*H.*) *fasciatus*, *C.* (*H.*) *speciosus*, *C.* (*J.*) *conasaugaensis*, *C.* (*P.*) *coosae*, *C.* (*P.*) *hiwasseensis*, *C.* (*P.*) *parrishi*, and *P.* (*Pe.*) *spiculifer*. The entocytherid associates are *An. telmoecea*,

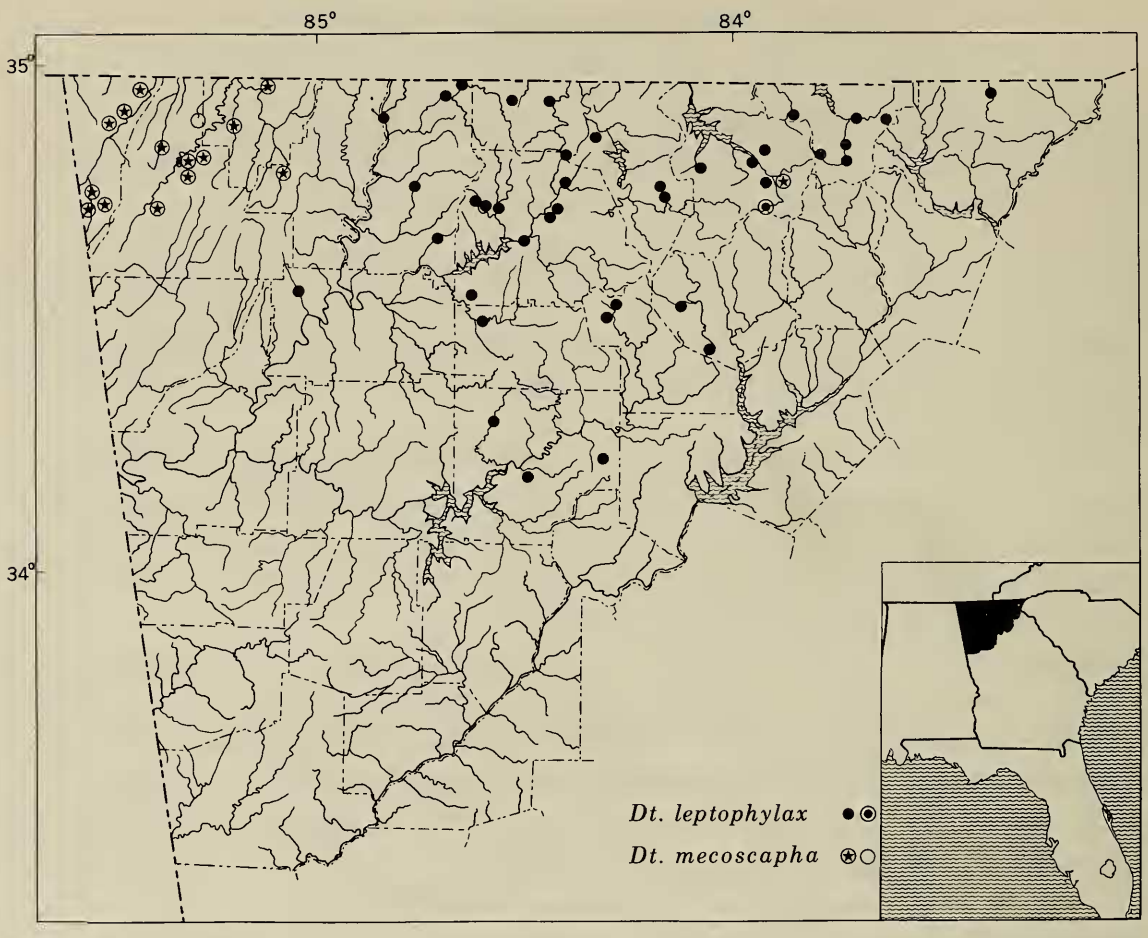

Fig. 6. Distribution of *Dactylocythere leptophylax* and *Dactylocythere mecoscapha* in northern Georgia (encircled spot and open triangle denote previously reported localities).

C. cyma, Dt. falcata, Dt. mecoscapha, Dt. prominula, Dn. donnaldsonensis, E. elliptica, and *U. simondsi.*

Dactylocythere mecoscapha (Hobbs and Walton)
Fig. 6

Entocythere mecoscapha Hobbs and Walton, 1960:19–23, figs. 17–20.
Dactylocythere mecoscapha Hart, 1962:130.—Hart and Hart, 1974:62–63, pl. 17, figs. 1–5; pl. 48.—Hobbs, 1981:380, 499, 500.

Range.—This ostracod occurs in the tributaries of the westwardly flowing segment of the Tennessee River from Polk County, Tennessee, and Dade, Walker, Catoosa, and Union counties, Georgia, to Colbert and Lauderdale counties, Alabama. The record from Hampton County, South Carolina, cited by Hart and Hart (1974:63), is almost certainly erroneous, for this low-lying area of the Coastal Plain Province furnishes unlikely habitats for any member of the genus *Dactylocythere* except *Dt. suteri.*

Previous records from northern Georgia.—This ostracod was reported by Hart and Hart (1974:63) from the Chickamauga National Military Park near Rossville (Chickamauga Creek basin). Its hosts were *P.* (*O.*) *lophotus, O. erichsonianus,* and *C.* (*D.*) *striatus.*

Distribution in northern Georgia.—In Georgia, *Dactylocythere mecoscapha*

has been found in 17 localities, all except one of which occurs in the Appalachian Plateau and Ridge and Valley provinces. There are two records in the Blue Ridge Province (Wolf Creek and Nottely River) in Union County, so close together as to be recorded herein by a single spot on Map 6. All 17 localities are in tributaries of the Tennessee River. In the area under investigation, the hosts of this ostracod are: *C.* (*C.*) *bartonii, C.* (*D.*) *latimanus, C.* (*D.*) *striatus, C.* (*H.*) *girardianus, C.* (*H.*) *longirostris, C.* (*J.*) *unestami, C.* (*P.*) *extraneus, C.* (*P.*) *hiwasseensis, O. erichsonianus, O. spinosus,* and *P.* (*O.*) *lophotus.* Its entocytherid associates are *An. telmoecea, Dt. falcata, Dt. leptophylax, Dn. donnaldsonensis, E. elliptica, E. illinoisensis,* and *U. simondsi.*

Dactylocythere prominula Hobbs and Walton
Fig. 5

Dactylocythere prominula Hobbs and Walton, 1977:606–609, fig. 3.

Range.—Except for the single new locality cited herein, this ostracod is known to occur only in the Tennessee River basin from Hawkins County, Tennessee, southward to Walden Gorge and a single outlying locality in the Elk River watershed in Lincoln County, Tennessee. In this survey, it was found in a tributary to the Conasauga River in extreme northeastern Murray County, Georgia.

Previous records in northern Georgia.—None.

Distribution in northern Georgia.—*Dactylocythere prominula* was found infesting *C.* (*C.*) *bartonii* in a small unnamed tributary to the Conasauga River (Blue Ridge Province) about 4.0 mi E of U.S. Hwy 411 on St Rte 2. At this locality it shared its host with *Dt. leptophylax* and *E. elliptica.*

Dactylocythere suteri (Crawford)
Fig. 7

Entocythere suteri Crawford, 1959:162–167, pl. 3.
Dactylocythere suteri.—Hart, 1962:131.—Hart and Hart, 1974:72–73, pl. 21, figs. 11–15; pl. 49.—Peters, 1975:28, figs. 4a, 9.—Hobbs and Peters, 1977:41–43, fig. 20, map 10.—Hobbs, 1981:231, 295, 498–500.

Range.—From the Susquehanna Basin in York County, Pennsylvania, southward on the Atlantic slope to the Oconee River drainage in Morgan County, Georgia. In the Gulf watershed, it occurs in the Conasauga Basin in Murray County, Georgia, and in the Tennessee Basin in McMinn County, Tennessee.

Previous records in northern Georgia.—Hart and Hart (1974:73) reported the presence of this ostracod in Holly Creek, Murray County (see below).

Distribution in northern Georgia.—In this area *Dactylocythere suteri* appears to be restricted to the Ridge and Valley Province where it has been found in the following localities in the Conasauga watershed. Murray County: (1) Holly Creek 1 mi E of Chatsworth on U.S. Hwy 76 (Hart and Hart 1974:73) (hosts: *Cambarus* (*D.*) *striatus, C.* (*P.*) *coosae,* and *O. spinosus*; associates: *Dt. falcata* and *U. simondsi*); (2) trib to Conasauga River 0.8 mi N of St Rte 2 on U.S. Hwy 411 (hosts: *C.* (*D.*) *striatus, C.* (*L.*) *acanthura,* and *C.* (*P.*) *coosae*; associates: *C. cyma, Dt. falcata,* and *U. simondsi*); (3) trib to Conasauga River on St Rte 225 between jct of St Rtes 2E and 2W (hosts: *C.* (*D.*) *striatus* and *C.* (*P.*) *coosae*;

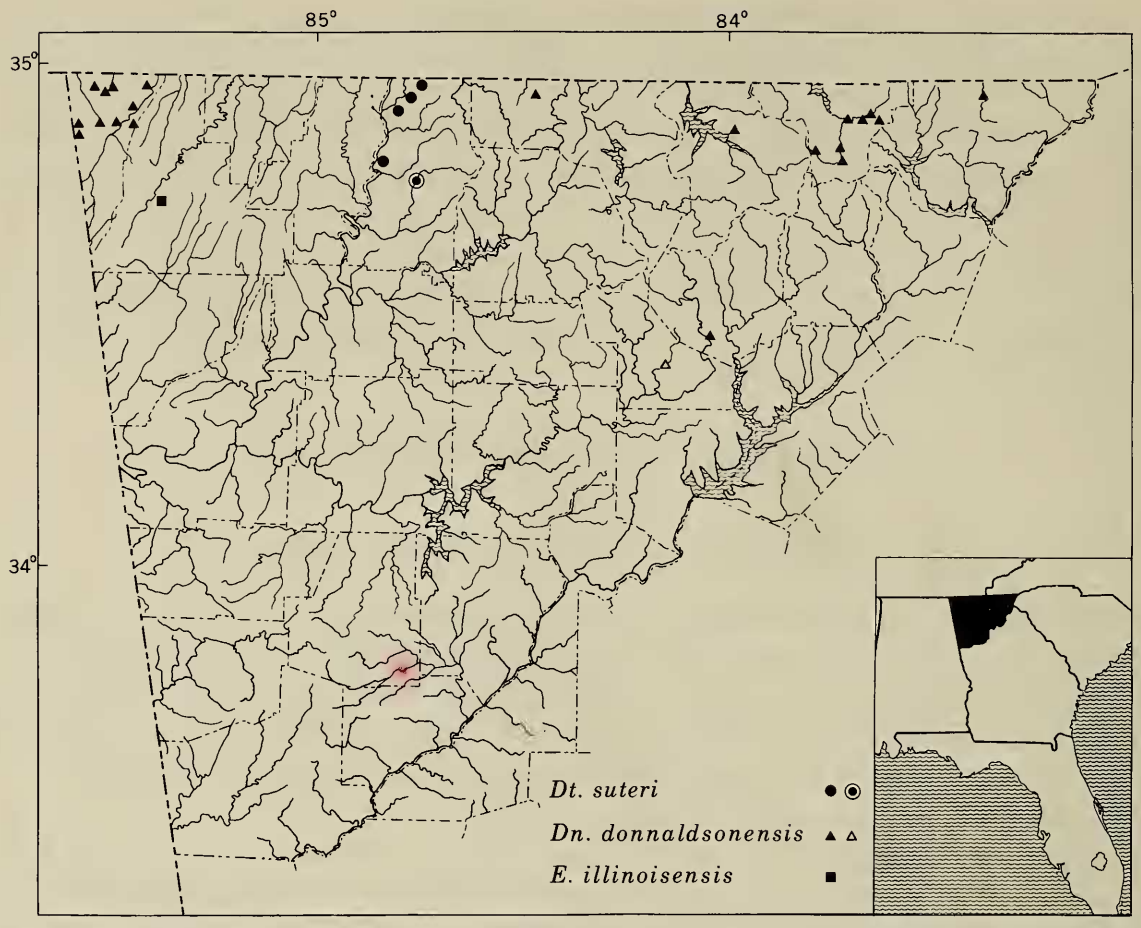

Fig. 7. Distribution of *Dactylocythere suteri, Donnaldsoncythere donnaldsonensis,* and *Entocythere illinoisensis* in northern Georgia (encircled spot and open triangle denote previously reported localities).

associate: *U. simondsi*); (4) drainage ditch 2.1 mi E of Conasauga River on St Rte 2 (hosts: *C.* (*D.*) *striatus* and *C.* (*L.*) *acanthura*; associates: *C. cyma* and *U. simondsi*); (5) stream 0.2 mi W of St Rte 225 on Rte 286 (hosts: *C.* (*H.*) *coosae* and *O. spinosus*; associates: *Dt. falcata* and *E. elliptica*).

Donnaldsoncythere donnaldsonensis (Klie)
Fig. 7

Entocythere donnaldsonensis Klie, 1931:334–341, figs. 1–9.
Donnaldsoncythere donnaldsonensis.—Hart, 1962:131–132.—Hart and Hart, 1974:79–80, pl. 23, figs. 11–14; pl. 50.—Hobbs and Peters, 1977:43–45, fig. 21, map 4 [including a complete synonymy].—Hobbs, 1981:70, 156, 231, 450, 498–500.
Entocythere hiwasseensis.—Hobbs, 1981:70.
Donnaldsoncythere hiwasseensis.—Hobbs, 1981:70, 156, 231, 450.

Range.—"From northern Georgia to Indiana and Maine" (Hobbs and Peters 1977:44).

Previous records in northern Georgia.—Hart and Hart (1974:79) reported it as *Donnaldsoncythere hiwasseensis* from Shoal Creek in the Etowah Basin in Dawson County where it infested "*C.* (*Puncticambarus*) sp." (probably *C.* (*H.*) *fasciatus*).

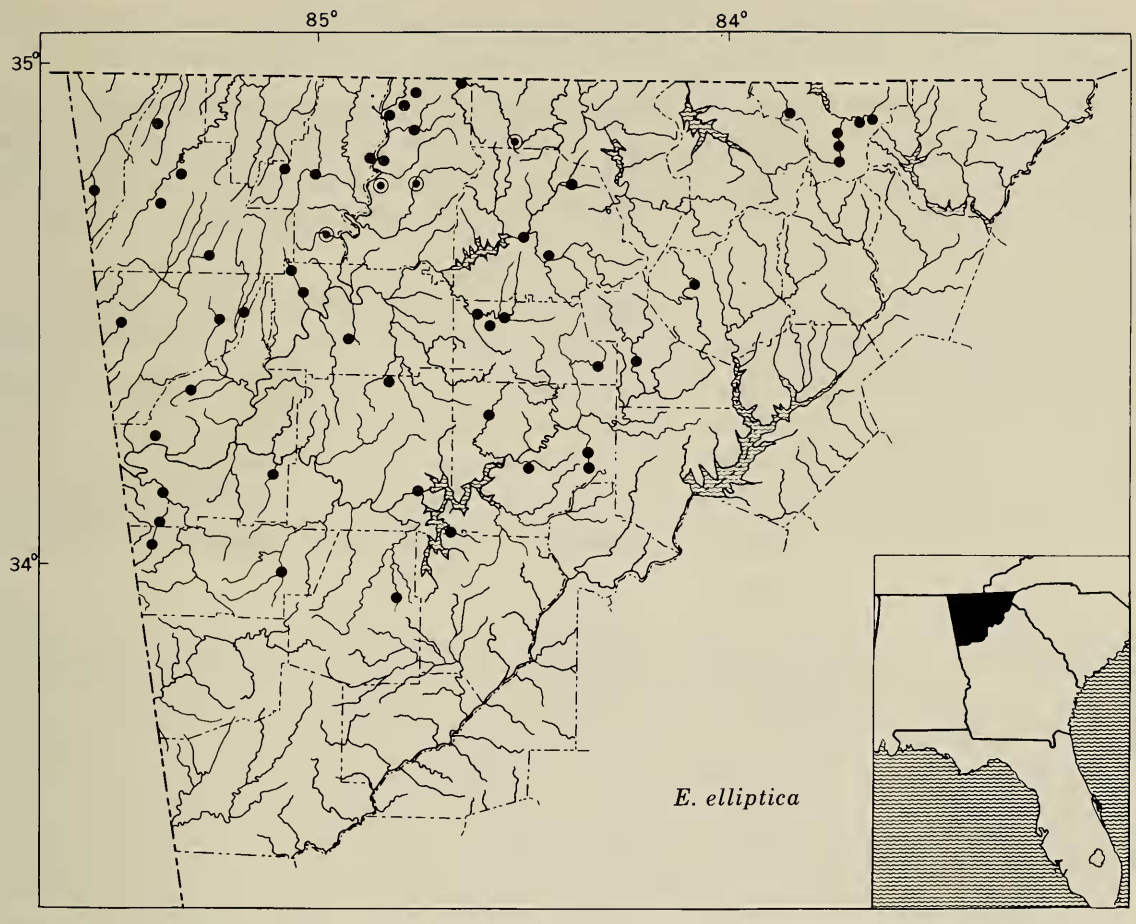

Fig. 8. Distribution of *Entocythere elliptica* in northern Georgia (encircled spots denote previously reported localities).

Distribution in northern Georgia.—*Donnaldsoncythere donnaldsonensis* has been found in 22 localities in the Appalachian Plateau, Blue Ridge, and Piedmont provinces in tributaries of the Tennessee, Hiwassee, and Little Tennessee rivers, and in headwaters of the Etowah River. Possible hosts in the area are *C.* (*C.*) *bartonii, C.* (*D.*) *striatus, C.* (*H.*) *fasciatus, C.* (*H.*) *girardianus, C.* (*J.*) *conasaugaensis, C.* (*J.*) *distans, C.* (*J.*) *nodosus, C.* (*J.*) *parvoculus, C.* (*J.*) *unestami, C.* (*P.*) *georgiae, C.* (*P.*) *hiwasseensis, C.* (*P.*) *parrishi,* and *O. erichsonianus.* The entocytherid associates are *As. bouchardi, Dt. brachystrix, Dt. leptophylax, Dt. mecoscapha, E. elliptica,* and *U. simondsi.*

Entocythere elliptica Hoff
Fig. 8

Entocythere elliptica Hoff, 1944:345–349, figs. 15–21.—Hart and Hart, 1974:87–88, pl. 26, figs. 1, 2; pl. 51.—Hobbs, 1981:71, 231, 295, 312, 399, 403, 431, 450, 498–501.

Range.—Hart and Hart (1974:227) depicted the range of this ostracod as extending from extreme southeastern Texas to South Carolina and the northern part of the peninsula of Florida, and northward through most of eastern Mississippi, Alabama, and Georgia.

Previous records in northern Georgia.—Hart and Hart (1974:88) reported this

species from two localities in Murray and one each in Fannin and Whitfield counties.

Distribution in northern Georgia.—As noted in Fig. 8, this ostracod has been found in 54 localities scattered through all of the physiographic provinces of the region as well as in all of the watersheds except the Little Tennessee River. Its 23 hosts and 11 entocytherid associates in the area are summarized in Tables 2 and 3.

Remarks.—In treating the entocytherid fauna of North Carolina, Hobbs and Peters (1977) recognized five species of the genus *Entocythere* in the state. They were convinced that *Entocythere harrisi* Peters (1975:32), *E. internotalus* Crawford (1959:152), and *E. reddelli* Hobbs and Walton (1968:243) were all represented, and although some difficulty was encountered in separating them, they believed that combinations of characteristics of the male and female genitalia and those of the pectinate prominence at the base of the apical claws of the antenna of the female provided a means of recognizing the three.

In studying the Georgia representatives of the genus, we have found those combinations of characters to be unreliable. Whereas specimens assignable to each are present in the northern Georgia fauna, there are also individuals that appear to be typical of Hoff's *Entocythere elliptica*. Both of us were surprised when in one specimen of the genus we found one of the paired clasping apparatus of the male to be typical of that of *E. internotalus* and the other characteristic of *E. elliptica*. A similar asymmetry of the corresponding elements resembling those of *E. internotalus* and *E. reddelli* was encountered later in several specimens.

Employing the key we had prepared to the North Carolina fauna, we found that among the specimens from one of the localities in Georgia all of the males were members of *E. internotalus* but the females appeared to belong to *E. reddelli*. Repeated examination of the material available to us from northern Georgia has almost convinced us that insofar as the development and position of the "internal talon" on the clasping apparatus is concerned, much of the difference noted results from the position of the apparatus when viewed, and whereas the position and development of the teeth (often appearing to be absent) of the talon may be variable, the direction from which they are viewed minimizes or enhances the marginal structures of the talon.

The female genitalia are indeed highly variable regardless of the angle at which they are examined, even more so than those illustrated by Hobbs and Peters (1977:figs. 25f, 26e, and 27f). The presence of a vermiform tube in *E. harrisi,* a simple sinuous sclerotized thickening in *E. reddelli,* and the compound sclerotized element in *E. internotalus* does not characterize the triunguis females collected in northern Georgia. In at least three of them there are no discernible genitalic structures. Among other specimens the genitalia are intermediate in their complexity between those of *E. internotalus* and *E. reddelli*. Finally, a vermiform tube was observed in at least one of the females from the Coosa Basin to be incorporated in a genital complex that is otherwise typical of *E. internotalus*.

The pectinate prominence at the base of the apical claws of the antenna of the triunguis female from northern Georgia surprisingly varies from two to at least 10 pectins. Generally the fewer the number the more prominent the pectin. In seven specimens from a single locality in Cherokee County the full range of variability was represented, and even in localities in which the number and po-

Table 4.—Variation in size of *Entocythere elliptica* in the Coosa Basin of northern Georgia.

Sub-basin	Sex	Number	Length in mm		Height in mm	
			Range	Average	Range	Average
Conasauga	♂	22	0.434–0.490	0.473	0.189–0.210	0.197
	♀	32	0.560–0.651	0.590	0.273–0.343	0.280
Coosa	♂	17	0.413–0.511	0.447	0.175–0.231	0.199
	♀	16	0.546–0.630	0.578	0.266–0.294	0.281
Coosawattee	♂	14	0.420–0.483	0.450	0.182–0.224	0.199
	♀	18	0.532–0.616	0.571	0.245–0.294	0.266
Etowah	♂	23	0.406–0.476	0.435	0.175–0.210	0.193
	♀	24	0.504–0.630	0.548	0.245–0.315	0.278
Entire upper Coosa Basin	♂	76	0.406–0.511	0.450	0.175–0.231	0.197
	♀	90	0.504–0.651	0.577	0.245–0.343	0.276

sition of the pectins exhibit little variability, always one or two individuals were, in this respect, atypical of the remainder of the population.

In view of the range of the complex, from Texas to Virginia (Hobbs and Peters 1977:52, 55), and the broad areas within it from which no specimens are available, we are loath to synonymize any of the three with Hoff's *E. elliptica*. Because we are uncertain as to the identity of the highly variable populations in northern Georgia, however, we are tentatively assigning our specimens from the area to the first named of the four, *E. elliptica*.

Measurements were made of the length and height of the males and females throughout the study area (Table 4). The average length of specimens from the Conasauga is greater than that of individuals from the other three sub-basins in the Coosa watershed and is least in those from the Etowah. In the latter, specimens from the upper part of the drainage system in Dawson and Lumpkin counties have shorter average lengths (♂, 0.429 and 0.417; ♀, 0.504 and 0.526 mm, respectively) than in the middle (♂, 0.440; ♀, 0.573 mm) and lower parts (♂, 0.462; ♀, 0.602 mm) of the sub-basin.

Entocythere illinoisensis Hoff
Fig. 7

Entocythere illinoisensis Hoff, 1942:67–69, figs. 1–8.—Hart and Hart, 1974:88–90, pl. 26, figs. 3–4; pl. 51.

Range.—From Michigan southward to northwestern Georgia, northern Alabama and Mississippi, and west of the Mississippi River in Arkansas.

Previous records in northern Georgia.—None.

Distribution in northern Georgia.—In this area, *Entocythere illinoisensis* is known from a single locality, a tributary to Chickamauga Creek 9.8 mi E of the Dade County line on St Rte 143, Walker County. This stream lies in the Ridge and Valley Province, and the crayfish hosts were *Cambarus* (*D.*) *striatus*, *C.* (*H.*) *girardianus*, *C.* (*P.*) *extraneus*, *Orconectes erichsonianus*, and *P.* (*O.*) *lophotus*. It was associated with the following entocytherids: *Dactylocythere mecoscapha*, *Entocythere elliptica*, and *Uncinocythere simondsi*.

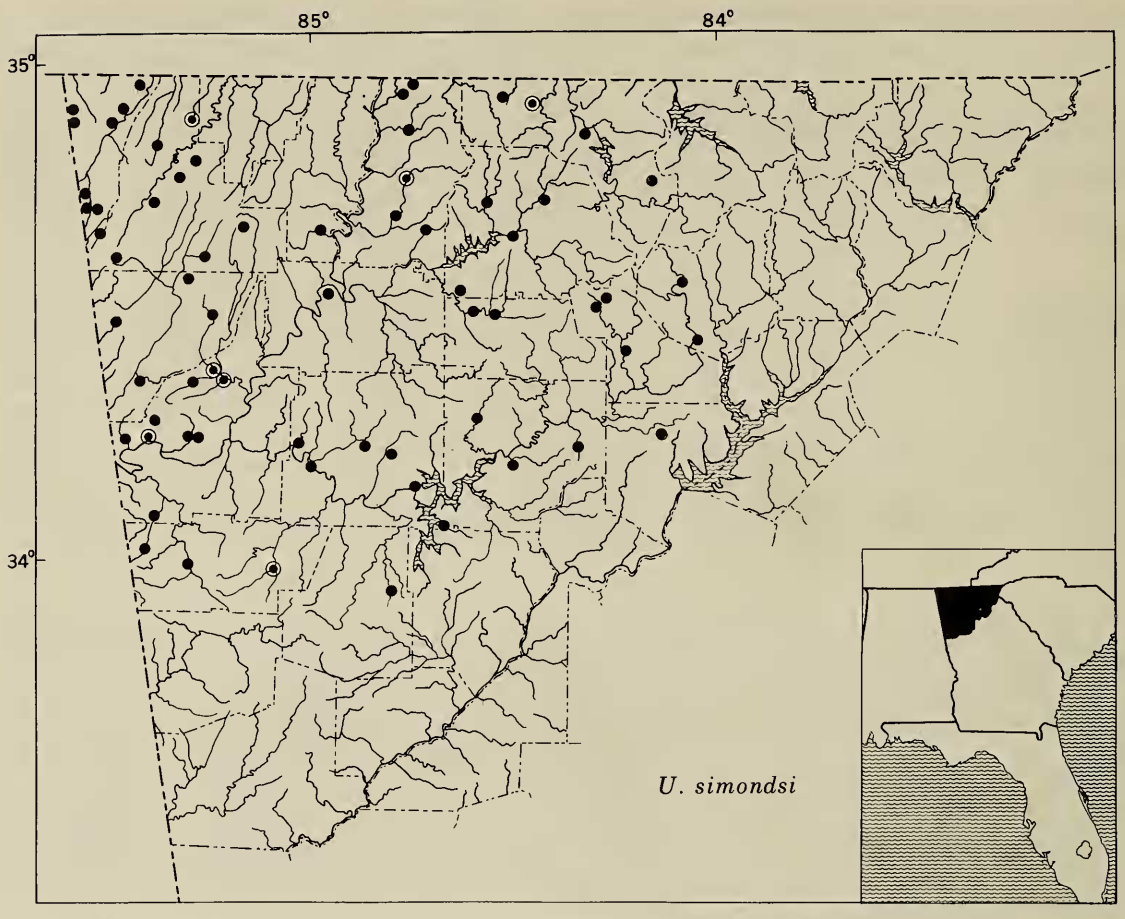

Fig. 9. Distribution of *Uncinocythere simondsi* in northern Georgia (encircled spots denote previously reported localities).

Uncinocythere simondsi (Hobbs and Walton)
Fig. 9

Entocythere simondsi Hobbs and Walton, 1960:17, 18, figs. 1–10.—Hobbs, 1981:70, 71.

Uncinocythere simondsi.—Hart, 1962:138.—Hart and Hart, 1974:133–135, pl. 37, figs. 4–7, pl. 55.—Hobbs and Peters, 1977:63–64, fig. 33, map 5.—Hobbs, 1981:70, 71, 97, 215, 231, 295, 380, 450, 598–501.

Range.—Hart and Hart (1974:231) reported this crayfish to occur from Illinois and Kentucky southward to the panhandle of Florida and from Mississippi eastward to Georgia and South Carolina. Hobbs and Peters (1977:70) added 25 localities in the western half of the state of North Carolina.

Previous records in northern Georgia.—This ostracod was reported by Hart and Hart (1974:134) from seven localities in the area under consideration (Fig. 9, open circles).

Distribution in northern Georgia.—*Uncinocythere simondsi* has been collected in 68 localities in all of the physiographic provinces in the area. Except in the Nottely and the Hiwassee rivers in Union and Towns counties and in the Little Tennessee River in Rabun County, it is widespread in northern Georgia where it has been found on all of the crayfishes in the area except *Cambarus* (*J.*) *distans*, *C.* (*J.*) *nodosus*, *C.* (*P.*) *georgiae*, *C.* (*P.*) *parrishi*, and *Orconectes forceps* and

was associated with all of the entocytherids occurring in northern Georgia except *Dactylocythere brachystrix* and *Dt. prominula*.

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